



June 10, 2015

L-2015-167
10 CFR 50.73

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Re: St. Lucie Unit 2
Docket No. 50-389
Reportable Event: 2015-001
Date of Event: 4/11/2015
Unit 2 Shutdown Due to Through Wall Crack and Leak in the 2B2 Safety Injection Tank Discharge Pipe

The attached Licensee Event Report 2015-001 is being submitted pursuant to the requirements of 10 CFR 50.73 to provide notification of the subject event.

Respectfully,

Christopher Costanzo
Site Vice President
St. Lucie Plant

CRC/lrb

Attachment



LICENSEE EVENT REPORT (LER)

(See Page 2 for required number of
digits/characters for each block)

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME St. Lucie Unit 2	2. DOCKET NUMBER 05000389	3. PAGE 1 OF 3
--------------------------------------	------------------------------	-------------------

4. TITLE Unit 2 Shutdown Due to Through Wall Crack and Leak in the 2B2 Safety Injection Tank Discharge Pipe
--

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	11	2015	2015	001	00	06	10	2015	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE	11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)			
1	<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(i)(C)	<input type="checkbox"/> 50.73(a)(2)(vii)
	<input type="checkbox"/> 20.2201(d)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)
	<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(ii)(B)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)
	<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 50.36(c)(1)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)(A)
10. POWER LEVEL 100	<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 50.36(c)(1)(ii)(A)	<input type="checkbox"/> 50.73(a)(2)(iv)(A)	<input type="checkbox"/> 50.73(a)(2)(x)
	<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(v)(A)	<input type="checkbox"/> 73.71(a)(4)
	<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.46(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(v)(B)	<input type="checkbox"/> 73.71(a)(5)
	<input type="checkbox"/> 20.2203(a)(2)(v)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(A)	<input type="checkbox"/> 50.73(a)(2)(v)(C)	<input type="checkbox"/> OTHER
	<input type="checkbox"/> 20.2203(a)(2)(vi)	<input checked="" type="checkbox"/> 50.73(a)(2)(i)(B)	<input type="checkbox"/> 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER	
LICENSEE CONTACT Lyle R. Berry, Licensing Engineer	TELEPHONE NUMBER (Include Area Code) (772) 467-7680

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT									
CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	BQ	PSP	E065	Y					

14. SUPPLEMENTAL REPORT EXPECTED <input type="checkbox"/> YES (If yes, complete 15. EXPECTED SUBMISSION DATE) <input checked="" type="checkbox"/> NO	15. EXPECTED SUBMISSION DATE MONTH DAY YEAR
---	--

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On 4/11/2015 at 1204 EDT, a through wall leak was identified during an investigative walk down of the 12-inch diameter Class 2 piping for the 2B2 safety injection tank (SIT) discharge header. Operators declared the SIT inoperable and Technical Specification Limiting Condition of Operation (LCO) 3.5.1 action "b" was entered, which required the SIT to be restored to Operable status within 24 hours or shut down to Mode 3 within the next 6 hours. In accordance with Technical Specifications (TS) and plant procedures, operators subsequently shut down the unit to repair the leak. The shutdown was uncomplicated and all plant safety systems functioned as designed. The leaking piping was replaced and returned to service on 4/18/2015. A sample of the failed pipe was sent to a metallurgical laboratory for examination. Results of optical and electron microscopic evaluations revealed the cause of failure as low stress high cycle fatigue.

This condition is reportable in accordance with the following requirements: 1) 10 CFR 50.73(a)(2)(i)A, "The completion of a nuclear plant shutdown required by the plant's Technical Specifications," and 2) 10 CFR 50.73(a)(2)(i)(B), "Any operation or condition which was prohibited by the plant's Technical Specifications." This condition was determined not to have a significant impact on the health and safety of the public, since the identified leakage was well within the plant capability to maintain SIT requirements and was insignificant as compared to either the SIT discharge flow rate or the safety injection flow rate during design basis events.

**LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET**

Estimated burden per response to comply with this mandatory collection request: 80 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the FOIA, Privacy and Information Collections Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to Infocollections.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
St. Lucie Unit 2	05000389	YEAR	SEQUENTIAL NUMBER	REV NO.	2 OF 3
		2015	- 001	- 00	

NARRATIVE**Description of the Event**

On 3/30/2015 at approximately 1645 EDT, operator review of Unit 2 control room logs revealed increasing leakage from 2B2 safety injection tank (SIT) (EIIIS: BQ, TK) evidenced by increasing depressurization rate and increasing rate of level loss with concurrent increase in rate of Reactor Cavity level rise. After discovery of the increasing SIT leak rate on 3/30/2015, a methodical plan to identify and eliminate the leak was executed and on 4/11/2015 at 1204 EDT, a through wall leak was identified during an investigative walk down of the 12-inch diameter Class 2 piping for the 2B2 SIT discharge header (line I-12"-SI-459) (EIIIS: BQ, PSP) located at an integral attachment weld of a support lug for support SI-4203-44 (EIIIS: BQ, SPT). Operators declared the 2B2 SIT inoperable and Technical Specification Limiting Condition of Operation (LCO) 3.5.1 action "b" was entered, which required the SIT to be restored to Operable status within 24 hours or shut down to Mode 3 within the next 6 hours. The unit was subsequently shut down to repair the leak. Mode 3 was achieved at 0123 on 4/12/2015. The shutdown was uncomplicated and all plant safety systems functioned as designed. The leaking pipe was replaced and returned to service on 4/18/2015.

Cause of the Event

The Root Cause for the piping failure was determined to be a legacy support design which created stress intensification in the piping that is not suitable for the vibration environment.

Analysis of Event

A sample of the failed pipe was sent to a metallurgical laboratory for examination. The metallurgical failure analysis confirmed the piping flaw progressed through wall by high cycle fatigue. The only source of loading identified that could produce the number of cycles to failure observed was vibration from the reactor coolant system. Evaluations of the support design revealed that the design of the welded lugs created an elevated local stress intensification that is not suitable for the environment where cyclic loading can occur. While the scope of the investigation did not include measurement of piping displacements from vibration, the evaluations of local stress concentration demonstrated that cyclic loading well below the normal operating loads would be sufficient to exceed the endurance limit for the material which would support the high cycle fatigue.

Safety Significance

The safety significance of this event is considered low. The flaw did not prevent the 2B2 safety injection tank from performing its design basis function based on the following considerations.

- The safety injection tank water volume, boron concentration and nitrogen pressure were maintained in accordance with the Technical Specifications.
- The extent of the leakage represents an insignificant fraction of the flow and volume delivered from the safety injection tank in the event of a design basis accident.
- The condition of leakage from the safety tank is continuously monitored by change in safety injection tank level.

LICENSEE EVENT REPORT (LER)
CONTINUATION SHEET

1. FACILITY NAME	2. DOCKET	6. LER NUMBER			3. PAGE
St. Lucie Unit 2	05000389	YEAR	SEQUENTIAL NUMBER	REV NO.	3 OF 3
		2015	- 001	- 00	

NARRATIVE

- In the event of a design basis accident, the safety injection tank performs its function in a relatively short period of time providing limited time for growth of the flaw.
- The SIT tank volume lost during a four hour Station Black Out (SBO) event is insignificant compared to the total volume of the four SIT's.
- In the event of a design basis accident, the safety injection tank pressure will drop reducing the stresses within the piping and the driving force for leakage through the flaw.
- A Probabilistic Risk Analysis (PRA) evaluation was developed with the conservative assumption that 2B2 SIT was inoperable for about 6 days (i.e., half the time between discovery of unidentified leakage on 3/30/2015 and discovery of 2B2 SIT leakage on 4/11/2015). The Conditional Core Damage Probability (CCDP) and Conditional Large Early Release Probability (CLERP) values were found to be below the thresholds of 1.0E-06 and 1.0E-07 for CCDP and CLERP, respectively, as required by RG-1.174 for the risk to be Small.

This condition is reportable in accordance with the following requirements: 1) 10 CFR 50.73(a)(2)(i)A, "The completion of a nuclear plant shutdown required by the plant's Technical Specifications," and 2) 10 CFR 50.73(a)(2)(i)(B), "Any operation or condition which was prohibited by the plant's Technical Specifications."

Corrective Actions

The corrective actions listed below are entered into the site corrective action program. Any changes to the actions will be managed under the corrective action program.

1. Engineering Design Change EC 283720 replaced the leaking piping spool piece with the through-wall flaw (line I-12"-SI-459) and modified the supports for line SI-459 and removed support SI-4203-44. This action was completed 4/18/2015.
2. Revise procedure STD-C-010, Piping and Support Analysis Requirements St. Lucie Units 1 and 2, to include more detail related to welded attachments specifically addressing avoiding extended lugs which develop a bending moment and considerations associated with using welded attachments in an environment which involves cyclic loading. This action is scheduled.

Similar Events

A review to identify similar events was performed by searching the condition reports in the plant corrective action data base initiated between March 1, 2010 and May 14, 2015. No previous similar events or causal analyses identifying fatigue failure of large bore piping were identified. A through wall leak of the 2B1 SIT vent valve weld reported in recent St. Lucie Unit 2 LER 2014-001-01, although in the same system and resulting from high cycle low stress fatigue, occurred on small bore piping due to a failure to comply with work order documents utilized by plant maintenance.

Failed Component

Piping Spool Piece I-12"-SI-459 is an ASME Class 2, Seismic Class I pipe with a design pressure of 700 psig and a design temperature of 350°F. The 12" pipe was originally made of SA-358, Cl. 1, TP 304 stainless steel with a nominal wall thickness of 0.375" (12" Schedule 40S, Pipe Code SS-3).

Manufacturer Ebasco Services, Inc ((E065))